

#### REMARKS

The Office Action dated October 10, 2007, has been received and carefully reviewed. The preceding amendments and following remarks form a full and complete response thereto. Claims 1, 17-18, 22-23, and 39-41 have been amended and dependant claims 42 and 43 are new. No new matter has been added. Accordingly, claims 1-11, 17-23, and 39-43 are pending in this application and are submitted for consideration.

#### *Interview Summary Under 37 C.F.R. § 1.133(b)*

On January 17, 2008, Applicants' representatives Richard Wydeven and John Curry met with Examiners Lee and Mosser to discuss the application. The parties discussed the rejections under 35 U.S.C. §§101-103.

Regarding the rejections under §101, the Applicants' attorneys explained that the calculated value determined by the claim has a specific and useful application. Additionally, the Applicants' representatives also proposed claims amendments to overcome the rejections. Regarding claims 22 and 23, the Applicants' representatives proposed that the claims be amended to include the step of "saving." The examiners indicated that the addition of this limitation would likely overcome the previous §101 rejections, but would require further consideration. Regarding claims 39-41, the Applicants' representatives proposed amendments that involved "using" the result of the calculations. Examiners indicated that such amendments would likely overcome the § 101 rejections, but would introduce new §112 first and second paragraph issues.

Regarding the rejections under §§102-103, the parties discussed the differences between U.S. Patent No. 6,144,838 to Sheehan and the Applicants' invention. The Examiner suggested that the previous rejections of the claims under § 102, and possibly under §103, would likely be overcome by adding explicit definitions of terms to the claim language for terms such as "learning targets," "learning map," "precursor," and "postcursor." The Examiner indicated that further search and consideration would be necessary if such changes were made.

***Claim Rejections Under 35 U.S.C. § 101***

Claims 22, 23, and 39-41 were rejected under 35 U.S.C. § 101 as directed to non-statutory subject matter. Applicants respectfully request withdrawal of the rejection and submit that claims 22, 23, and 39-41, as amended, recite statutory subject matter.

Claims 22 and 23 have been amended to better define a practical application of the tangible result of the methods for determining the inference values.

In the context of the present application, an inference value is a quantitative measure of how well one learning target serves as a precursor or postcursor to a second learning target. *See, e.g.*, Present Application at [0045]. A first learning target is a postcursor of a second learning target if demonstrated knowledge of the first learning target implies knowledge of the second learning target. *Id.* A postcursor inference value is a quantitative measure of the strength of that implication. *See* Present Application at [0047] – [0050]. The postcursor inference value is a value that represents the probability that a student knows the second learning target if it can be shown that the student knows the first learning target. *Id.* The postcursor inference value is calculated by dividing the number of students who have demonstrated knowledge of both the first and second learning targets by the number of students who have demonstrated knowledge of the first learning target. *See* Present Application at [0074]. The first learning target is a perfect postcursor if all the students who know the second learning target also know the first learning target (meaning that the number of students who know both the first and second learning targets equals the number of students who know the first learning target) – leading to a postcursor inference value of 1.0. Typically, the postcursor inference value will be some value less than 1.0.

Similarly, a first learning target is a precursor of a second learning target if a demonstrated lack of knowledge of the first learning target implies a lack of knowledge of the second learning target. *See, e.g.*, Present Application at [0045]. A precursor inference value is a quantitative measure of the strength of that implication. *See* Present Application at [0047] – [0050]. The precursor inference value is a value that represents the probability that a student does not know the second learning target if it can be shown that the student does not know the first learning target. *Id.* The precursor inference value is calculated by dividing the number of students who have demonstrated lack of knowledge of both the first and second learning targets by the number of students who have demonstrated lack of knowledge of the first learning target.

*See* Present Application at [0072]. The first learning target is a perfect precursor if all the students who lack knowledge of the second learning target also lack knowledge of the first learning target (meaning that the number of students who lack knowledge of both the first and second learning targets equals the number of students who lack knowledge of the first learning target)—leading to a precursor inference value of 1.0. Typically, the precursor inference value will be some value less than 1.0.

Claim 22 now recites saving the postcursor inference value for use in a learning map, and claim 23 now recites saving the precursor inference value for use in a learning map. Saving the inference values for use in a learning map is a useful and tangible result because by having an accurate picture of the dependencies between learning targets at varying levels of specificity, educators can construct efficient knowledge assessments. *See* Present Application at [0007]. Moreover, the inference value is indicative of the accuracy of the asserted precursor/postcursor relationship. Accordingly, the amendments to claims 22 and 23 obviate the basis for the Office's rejections. Applicants, therefore, respectfully request the withdrawal of the rejections of claims 22 and 23.

Claims 39-41 have also been amended to better define the invention and clarify ambiguities in the original claims. Claim 39 has been amended to recite the useful and tangible result of using the second learning map to evaluate the knowledge state of at least one student in the first group. Claims 40 and 41, which depend from 39, recite the useful and tangible result of using the third learning map to evaluate the knowledge state of at least one student in the second group. Accordingly, the amendments to claims 39-41 obviate the basis for the Office's rejections. Applicants, therefore, respectfully request the withdrawal of the rejections of claims 39-41.

***Claim Rejections under 35 U.S.C. § 102***

Claims 1 and 17-19 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 6,144,838 to Sheehan ("Sheehan"). Applicants respectfully submit that claims 1 and 17-19 recite subject matter not disclosed by Sheehan.

### Claim 1

Claim 1 is patentable over Sheehan because Sheehan fails to disclose a “means for creating a learning map, which comprises an acyclic directed network that expresses learning target dependencies including precursor and postcursor relationships between learning targets,” as claim 1 requires. Sheehan also fails to teach or suggest “means for assessing whether the learning target dependencies expressed by the learning map are accurate based on assessment data.”

The Office Action indicates that Sheehan’s Fig. 1 discloses a learning map. (Office Action at 4). Applicants respectfully disagree.

A learning target is a discreet learnable concept which represents knowledge or a skill a student is to acquire. *See* Present Application at [0004]. The learning target may be a smallest teachable concept (“TC”) at a defined depth of knowledge (“DOK”). *See* Present Application at [0050]. A learning map is an acyclic directed network that illustrates precursor/postcursor relationships between learning targets. As illustrated in Figure 3 of the application, a learning map 300 includes a set of nodes 311-315, which represent learning targets LT1-LT5, respectively. *See* Present Application at [0051] and Fig. 3. Learning map 300 also includes arcs 350-354 which illustrate the learning target postcursor/precursor relationships between the interconnected nodes (i.e. learning targets). *Id.* The arcs, or arrows, point from precursor to postcursor. LT1 is a precursor of LT2, which means lack of knowledge of LT1 implies lack of knowledge of LT2. LT4 is a postcursor of both LT2 and LT3, meaning that knowledge of LT4 implies knowledge of LT2 and LT3. LT3 and LT4 are both postcursors of LT2, meaning that knowledge of either LT4 or LT3 implies knowledge of LT2.

On the other hand, Sheehan’s Fig. 1 shows a tree-based analysis of SAT passage-based reading items. *See* Sheehan at Fig. 1; col. 12, lines 44-65. This is not a learning map – it is merely a way to categorize test items and to identify the skills tested by each item. For example, one of the four reading comprehension schemas is “vocabulary in context.” *See* Sheehan Fig. 1. That schema is then divided into two sub-schemas, one of which is “Standard Word Usage.” *Id.* Items 17, 33, and 16 (in increasing level of difficulty) are identified as relating to (i.e., testing) standard word usage. The nodes of Sheehan are a way of grouping test items at differing levels of granularity – i.e., from broad categories of test items to individual test items. *See* Sheehan at

Col. 12, lines 44-57. The various nodes shown in Sheehan's Figure 1 (the main node, the schemas, the sub-schemas, and the items) are not learning targets (i.e., discreet learnable concepts) presented so as to indicate precursor/postcursor relationships. "Reading Comprehension" is not a precursor of "Vocabulary in Context" which is not a precursor of "standard Word Usage" (or a postcursor of "Reading Comprehension") and "Standard Word Usage" is not a postcursor of "Vocabulary in Context."

The Office Action suggests the claimed "means for assessing" is taught in Sheehan at column 1, line 66 to column 2, line 22. Applicants respectfully disagree.

In accordance with the present invention, the accuracy of a learning map is assessed from assessment data (e.g., test performance) to determine if the precursor and postcursor relationships indicated in the learning map are accurate. Sheehan does not disclose learning maps and certainly does not disclose means for assessing the accuracy of a learning map. The cited disclosure at columns 1 and 2 of Sheehan merely describes a process for summarizing examinees' hypothesized skill mastery patterns (mastery/nonmastery status on each of  $k$  skills) to provide group level descriptions of the skill mastery status expected for students scoring at successive points on a test's reported score scale. (Sheehan, col. 2, lines 13-18). In other words, for each reported score point, the expected skill level of a student attaining that score is predicted from hypothesized skill mastery patterns. This is not evaluating assessment data to assess the accuracy of a learning map displaying precursor and postcursor relationships between learning targets.

Accordingly, Sheehan does not anticipate claim 1 because Sheehan fails to disclose a "means for creating a learning map" or "means for assessing." Applicants, therefore, respectfully request the withdrawal of the rejection of claim 1.

#### Claim 17

Sheehan does not anticipate claim 17, because Sheehan fails to disclose "specifying learning target dependency relationships for the specified learning targets" or "creating or updating a conditional probability table, which includes inference values, based on said specified set of learning targets and said specified learning target dependency relationships." The Office Action contends this feature is disclosed in Figure 1 and column 12, line 58- column 13, line 55

of Sheehan. (Office Action at 4) Applicants respectfully disagree. As discussed above, with respect to claim 1, Figure 1 of Sheehan does not indicate or relate to learning targets and learning target dependencies. Furthermore, there is no disclosure of a conditional probability table as claimed.

Moreover, for the reasons discussed above with respect to claim 1, Sheehan does not teach the step of “displaying an acyclic directed network corresponding to the conditional probability table, wherein the acyclic directed network comprises a node for each specified learning target and one or more arcs for illustrating specified learning target dependency relationships” as recited in claim 17.

Accordingly, Sheehan does not anticipate claim 17, and applicants, therefore, respectfully request the withdrawal of the rejection of claim 17.

#### Claim 18

Sheehan does not anticipate claim 18, because Sheehan fails to disclose the step of specifying precursors, postcursors, and precursor/postcursor learning target pairs, as claim 18 requires. Sheehan also fails to disclose the step of specifying precursor and postcursor inference values, as recited in claim 18. The Office alleges that this feature is disclosed in Figure 1 and column 12, line 58- column 13, line 55 of Sheehan, *see* Office Action at 4, but it is not. As discussed above, Sheehan simply does not disclose precursors, postcursors, and precursor/postcursor learning target pairs – it discloses test items that have no precursor or postcursor relationship to one another.

Moreover, for the reasons discussed above with respect to claim 1, Sheehan does not teach the step of “displaying an acyclic directed network that represents the precursor/postcursor relationships among the learning targets, wherein the acyclic directed network comprises a node for each specified learning target and one or more arcs for illustrating specified learning target precursor/postcursor relationships” as recited in claim 18.

Accordingly, Sheehan does not anticipate claim 18, and applicants, therefore, respectfully request the withdrawal of the rejection of claim 18.

Claim 19

Claim 19 is patentable for at least the same reasons as claim 18, from which it depends.

***Claim Rejections Under 35 U.S.C. § 103***

Claims 2, 9-11, 20-23, and 39-41 were rejected under 35 U.S.C. § 103(a) as unpatentable over Sheehan and Official Notice. Applicants respectfully submit that claims 2, 9-11, 20-23, and 39-41 recite subject matter neither disclosed nor suggested by the combination of Sheehan and what the Office has officially noted.

Claims 2 and 9-11

Claims 2 and 9-11, which depend from claim 1, are patentable for at least the same reasons as claim 1, discussed above.

Claims 20-23

Similarly, claims 20 and 21, which depend from claim 19, are patentable over Sheehan for at least the same reasons discussed above with respect to claim 19.

Furthermore, dependant claims 20 and 21 are additionally and independently allowable over Sheehan, and independent claims 22 and 23 are patentable over Sheehan, because Sheehan fails to disclose or suggest each and every element of claims 20-23, and the Examiner's "Official Notice" fails to remedy the deficiencies of Sheehan.

Claims 20-23 recite steps for computing precursor and postcursor inference values, which the Office acknowledges are not taught by Sheehan. *See* Office Action at 7. Moreover, the "Official Notice" does not make up for the admitted deficiencies of Sheehan. Even assuming the allegation that "using the results of student testing to determine probabilities related to mastery of subject material is old and well known in the art" is true, the Office has still failed to even allege that the specific steps recited in claims 20-23 for determining postcursor and precursor inference values are well known in the art. What was officially noticed does not correspond to the elements of claims 21 - 23 that are missing from Sheehan.

Accordingly, claims 20-23 are patentable over Sheehan. Applicants, therefore, respectfully request the withdrawal of the rejections of claims 20-23.

#### Claims 39-41

Claims 39-41 are patentable over Sheehan because the combination of Sheehan and the Official Notice fails to disclose or suggest each and every element of the claimed invention. For instance, as explained above, Sheehan fails to disclose a learning map, as recited in independent claim 39. The Office alleges that this feature is disclosed by Figure 1 and in column 1, line 66 – column 2, line 22 of the Sheehan's specification. This portion of the specification does not describe a learning map. Instead, it describes group-level diagnoses that are specified in terms of the combinations of skills needed to solve items located at increasingly higher levels on a test's reported score scale.

Furthermore, the Office's Official Notice fails to make up for the deficiencies of Sheehan because it does not encompass learning maps. Applicants, therefore, respectfully request the withdrawal of the rejections of claim 39 and claims 40-41, which depend from claim 39.

#### Claims 3-8

The Office rejected claims 3-8 as unpatentable over Sheehan in view of U.S. Patent No. 5,852,822 to Srinivassan et al. ("Srinivassan"). Applicants respectfully traverse and submit that claims 3-8 recite subject matter neither disclosed nor suggested by the combination of Sheehan and Srinivassan.

Claims 3-8 are patentable for at least the same reasons as claim 1. That is, while Srinivassan is cited by the Examiner for its purported disclosure of "merging nodes and splitting nodes," it fails to overcome the deficiencies of Sheehan with regard to the subject matter of claim 1, from which claims 3-8 depend.

Furthermore, dependent claims 4, 5, 6, and 8 are allowable for the following additional and independent reasons.

Claim 4 recites "means for modifying the learning map ... configured to modify the learning map in response to the assessing means determining that two or more learning targets included in the learning map represent the same or essentially the same targeted concept." Claim 5 recites that the modifying means is configured to combine two or more learning targets determined to represent the same learning target. Claim 6 recites "means for determining



whether the learning map includes a learning target that represents more than one targeted concept.” Claim 8 recites that the modifying means is configured to split learning target determined to represent more than one targeted concept. Srinivassan does not disclose any of these features.

Srinivassan discloses that leaf nodes in a multi-level index are “split” by moving leaf nodes to a new (empty) index leaf node if there is insufficient free space for an entry in an existing index leaf node. (col. 6, lines 9-13). Srinivassan also discloses that leaf nodes in the multi-level index are “merged” by moving a series of neighboring leaf nodes into a single leaf node when more space in the single leaf node becomes available due to deletions. (col. 6, lines 13-17). Srinivassan does not disclose merging two or more learning targets that are determined to represent a single targeted concept or splitting a learning target that is determined to represent two or more concepts.

Accordingly, dependent claims 4, 5, 6 and 8 are allowable for this additional and independent reason.

#### *New Claims*

New claim 42 depends from claim 22 and is patentable for at least the same reasons stated above with respect to claim 22. Furthermore, Applicants submit that claim 42 is patentable for the additional reason that none of the cited art teaches determining that the specified precursor/postcursor learning target pair has a valid postcursor relationship if the postcursor inference value exceeds a defined minimum threshold, as claim 42 requires.

New claim 43 depends from claim 23 and is patentable for at least the same reasons stated above with respect to claim 23. Furthermore, Applicants submit that claim 43 is patentable for the additional reason that none of the cited art teaches or suggests determining that the specified precursor/postcursor learning target pair has a valid precursor relationship if the precursor inference value exceeds a defined minimum threshold.

Applicants, therefore, respectfully submit that new claims 42 and 43 are allowable.

**CONCLUSION**

In view of the above, all objections and rejections have been sufficiently addressed. Applicants submit that the application is now in condition for allowance and request that claims 1-11, 17-23, and 39-43 be allowed and this application passed to issue.

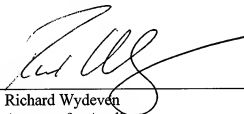
In the event that this paper is not timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account No. 02-2135.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

Respectfully submitted,

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By



Richard Wydevan  
Attorney for Applicants  
Registration No. 39,881  
ROTHWELL, FIGG, ERNST & MANBECK, p.c.  
Suite 800, 1425 K Street, N.W.  
Washington, D.C. 20005  
Telephone: (202)783-6040